

VIIA. *The Habits of Asemum striatum and Criocephalus ferus.*

[Read February 1st, 1905.]

Asemum striatum was, prior to 1902, known in Great Britain almost exclusively as an inhabitant of Scotch fir (*Pinus sylvestris*) forests in Scotland.

Dr. Sharp recorded a specimen from Dumfriesshire in 1879. Messrs Rye and Skinner in recording the capture of a specimen in 1893, in the New Forest, said—"We believe this to be the earliest record of the species from the South of the Border" ("Entom. Mo. Mag." xxx, 1894, p. 277). Nevertheless we have no doubt that it has been abundant in the New Forest for a long period of years, and has only failed to be detected because of its habits.

During May and June in 1902, while staying at Bournemouth, I made several entomological excursions, with the express purpose of obtaining Longicorn beetles in the larval and pupal stages. It is well known to be very difficult to rear these insects, and it may therefore be well to explain my method.

My articles of equipment for this work included a thin-edged teaspoon for picking up larvæ and pupæ; a small tobacco-box fitted up with short lengths of bamboo-cane of different diameters to serve as artificial burrows for the pupæ. The nearer the bamboo sections correspond with the burrows from which pupæ are taken, the greater are the chances of rearing them.

Also a number of cylindrical strong glass bottles with metal screw caps, each one of which is intended for a separate larva. The bottles are filled tightly with two or three pieces of wood and wood refuse taken from the larval burrows; a suitable cavity is made between the pieces of wood and the larva is inserted. Care is necessary in order that the larva is not too tight nor yet too loose. Once the larva is well established in its new burrow there is not much risk of its dying. M. Valery Mayet advocates the keeping of the Longicorn larvæ in galleries bored by a large gimlet in solid wood (Bedel, Fauna Col. Seine V, p. 77). For larvæ in their last year or so, however, the

method I describe is very useful, and with care quite satisfactory. The chief thing to guard against is empty cavities which encourage mildew.

I secured and reared at this time several of the more common species, and at a place near the South Coast I first made acquaintance with *Asemum striatum*.

Emerging from a Scotch fir wood which I had been working for some hours, and feeling tired, I sat down on one of a great number of stumps of fir-trees which had been cut down three or four years previously.

The tops of the stumps rose several inches above the roots. I immediately noticed a number of distinctly oval and clean-cut holes on the table-like surface of the stump and concluded that they were the work of a Longicorn unknown to me.

While examining these holes I noticed a new hole actually beginning to form, and through it a mandible of a beetle appeared. With my knife I enlarged the hole until the boring itself was laid open to view. The beetle however had vanished down its burrow. I therefore brought a small axe into play. I soon found however that the stump was perfectly sound and almost as hard as my axe; added to which, the roots radiating in all directions made it impossible to split off large pieces. However, after about an hour's hard work I came in sight of the beetle, but not of the bottom of its hole, for it seemed to be able to retreat indefinitely. I at last laid down my axe and sticking a pin into the end of a thin twig hooked the beetle out minus two legs. This was my first *Asemum striatum* taken from the bottom of its gallery thirteen or fourteen inches long excavated in solid Scotch fir. This concluded my day's work, but I revisited the spot next day, and after investigation I found that most of the stumps were covered with holes almost all of which were quite recent, and I also discovered that if I approached very cautiously I could see the heads of the beetles at the mouths of their burrows; in many cases they were widening them to the required size of exit. In some stumps I thus observed as many as twenty beetles at once. But to secure them was quite a different matter; for as soon as I touched a stump every beetle disappeared down its hole not to appear again for an hour or so. I spent several days carefully investigating the situation; during which time I was only successful in securing about

half-a-dozen maimed specimens. One stray specimen I found on the ground among bits of bark. I did not see one on the wing although there was brilliant sunshine. During these two or three days I must have seen many hundreds of the insect, all in their holes. The explanation of this is that the insect is purely nocturnal in its habits, taking refuge in its burrows during the daytime when possible. It would appear however that though nocturnal, it likes the sunshine, as most Longicorns do. The odd specimens which subsequent to 1902 have been found at different places have been stray insects most likely near very strong colonies, seeing that from the colony I refer to I only found one straggler. During the last day I spent at this place at this time I devised a very simple but effective method of obtaining specimens, and I took in half-a-day about eighty. It would not, I think, be fair to the insect to make this method generally known. Among this number there were two of the var. *agrestis*, which is a true variety and not an immaturity, as has been supposed.

The normal insect, while undergoing the process of hardening never assumes the brick-red tint of var. *agrestis*, but rapidly changes from various hues of dull brown to pitchy black; some however are not so black as others, while var. *agrestis* having once arrived at the brick-red colour retains that hue. Dr. Sharp has taken a stray specimen of the var. *agrestis* on the wing, which proves its maturity.

The situation I have referred to fulfilled at the time the conditions necessary for a successful colony, which are as follows:—

- i. That the wood shall be dead or enfeebled, but not have commenced to decay.
- ii. The wood must not have been attacked previously by *Rhagium bifasciatum*, as the two are not friendly, though the existence of *Aseum* facilitates that of *Rhagium*.

Probably the insect exists in the same stump (not including the thin rootlets) during a maximum period of five years. My supposition is based on the following:—

Throughout the three years during which the first brood is maturing, there are no visible punctures on the

flat face of the stump, consequently the rain does not penetrate into the wood in quantities sufficient to hasten decay. Moreover, when the tree was felled a coating of resin was formed on the surface, which prevented the water from sinking in. For three years therefore the wood was perfectly sound and free from superfluous moisture and quite unsuitable for the accommodation of *Asemum's* greatest enemy, viz. *Rhagium bifasciatum*.

During these three years successive broods of larvæ entered upon existence.

When at the end of this period the first brood emerged as perfect insects, the second brood had to live the final year of their lives under far less favourable conditions than the first; for every time it rained during that year, the open burrows of the larvæ that had already developed conducted the water into the centre of the stump, everywhere spreading decay, which had the effect of driving some of the larvæ deeper into the roots while many perished.

This was proved by the fact that when I revisited this spot the following year with my friend, Mr. Willoughby Ellis, although a fortnight later than in the previous year, there were but few recent though many old burrows.

The third brood exists under very unfavourable conditions; for, in the first place, they were tiny one-year larvæ when the rapid disintegration, caused by the open burrows conveying the rain into the stump, commenced. In the second place, these unfortunate larvæ before they were much older found that their burrows were repeatedly crossed with the ever widening ones of their great rival *Rhagium*, which species, owing to the decay caused by repeated rains, has now completely gained the mastery over the stump, so that the third brood of *Asemum* has very little chance of completing its development.

A few however succeed in finding their ways to the thin rootlets, and I have found in upturned stumps in the New Forest, the insect in all its stages; the rootlets sound but sometimes no thicker than one's little finger, the whole of the decayed part of the stump including the larger roots being given over to *Rhagium*.

Since the discovery of this colony I have found a great number of colonies of *Asemum* scattered all over the New Forest and in remote corners of Hampshire and Dorset,

and I have always observed that the insect is closely followed up by *Rhagium*.

It is thus clear that *Ascum striatum* and *Rhagium bifasciatum* together constitute one of the most potent (though unobtrusive) helps to forestry. For there is good reason for supposing that there is never a considerable number of Scotch firs felled in the New Forest but these two insects turn the opportunity to good account and speedily reduce the stumps to manure.

The former ever retreats before the progress of decay until retreat is no longer possible, while the latter delights in decay and feeds on decaying wood until it thus reduces the whole stump to powder, with the exception of the thinnest layer of outer wood which hides its depredation within. It often happens that a stump, the upper-surface of which is covered with *Ascum* holes, and would appear to contain larvæ of that insect, when tapped, completely collapses and appears but a mass of dust and manure. *Rhagium* is not what we may call a hard-working insect and does not make a hole of exit unless necessary, but uses any convenient fissure, or the holes of *Ascum*, for the purpose of exit.

The life-cycle of *Ascum* is as follows, viz. :—

At the end of May or early in June, a number of eggs are inserted between the scales of the bark on the sides of the stump or exposed portions of the thick roots. The young larvæ soon hatch and for some time feed on the bark itself. Having worked their way through the bark they do not bore between the bark and the wood as the *Callidiidae* do, but penetrate through the outer layer of wood, when, if they were deposited in the side of the stump, they commence working downwards, just under the surface of the wood, making as they proceed galleries, the calibre of which is in one direction slightly larger than their own bodies and in the other direction much wider. These galleries wind about and their margins are more or less tortuous. The larvæ when about half-grown have proceeded some distance down the stump, and they then connect the burrows with the outside by means of small holes. Up to this point, as they progressed, their galleries were completely and tightly filled behind them with wood-dust and refuse, which they had compressed so tightly that when dry it is almost as hard as the surrounding wood. Till this period, the decay of the stump

has not been at all hastened by these larvæ, for they have left behind them no communications that would facilitate the entrance and growth of mildew.

There are no punctures in the bark, and when this is removed there are generally no traces of borings on the inside of the bark, nor on the surface of the wood. The small borings through which the larvæ entered the wood itself are filled up and become almost imperceptible.

Owing to this absence of orifices, even though a stump may contain a great number of larvæ in this stage, one not acquainted with their habits would be most likely to overlook them.

But having made its communication with the exterior the larva's efforts have an additional object, for from henceforth they are partly directed towards making suitable provision for itself during its later stages. It for a time continues to bore downwards but with a more inward direction, and instead of compressing the refuse behind it as it previously did, it forces it through the orifice alluded to.

After pursuing this method for some time it concludes its downward course and enlarges the end of the burrow so as to form a sort of turning-space. This may be anything between eight to fifteen inches below the flat surface of the stump. The larva now changes its direction and strikes upwards, with a burrow which has a calibre somewhat more corresponding with the shape of its body, and also straighter than its downward burrow.

An upward burrow may at once be distinguished from a downward one by the fact that the latter is almost imperceptible on account of its being tightly filled with refuse, while the former is visible as it is free from *debris*.

When the larva has brought its gallery very close to the outside of the wood, it discontinues the gallery and pushes into the dome-shaped termination thereof a number of long wood-fibres, which it tightly compresses together. If this be not done to keep out the rain, I cannot suggest any other purpose.

In this completed and unobstructed upward-burrow, the larva lives for a considerable time, for I have found completed burrows in October, while the insect does not pupate till the following spring.

During this period it gradually ceases its activity and becomes whiter in colour. It pupates in May, remaining

in the pupa state about three weeks. The pupa is very active. It has no cocoon, but can use the whole of its upward-burrow (up and down which it frequently travels) for the purpose.

The extremity of its abdomen is provided with two long sharp spines which assist in this operation.

The way it progresses is interesting. It curls the extremity of its body underneath it, with the result that one of the spines becomes fixed into the side of the burrow. It then straightens itself. This operation continually repeated constitutes its mode of locomotion. Minute down-curved spines on the dorsal side of the abdomen prevent it from slipping down its burrow when stationary. A noteworthy point in reference to these spines is that they are the only hard and dark parts in the pupa immediately after its metamorphosis from the larva.

Apparently its object in travelling up and down its burrow is to prevent the growth of mildew upon its walls. I have observed that in glass tubes containing these and other Longicorn larvæ the galleries when occupied by healthy larva or pupa are immune from mildew, while the other parts of the wood may be badly infested.

It will be recalled that the pupa of the clear-wing moths are provided with serrations on the margins of their abdominal plates to assist them in travelling up and down their burrows in a similar manner.

These spines serve an additional purpose, for they assist the pupa in the initial stages of casting its skin, by enabling it to hold its body more rigid and in greater tension, while splitting open the thin skin at the back of its neck. It will thus be seen how necessary it is in rearing these and allied pupæ, to put them in tubes which afford them the same facilities for doing this as their native burrows do.

I have lost more pupæ from exhaustion in seeking to split this thin skin than from any other cause.

After undergoing its final metamorphosis *Asemum* matures rather rapidly.

The imago opens the roof of its prison when almost mature.

Seeing that their burrows are the only places where one can hope to find these insects, it seems pretty certain that when possible they always hide in them during the daytime, affording as they do such excellent retreats.

Asemum sometimes attacks standing trees, but only when the trees' vitality has been impaired. In such cases the upward borings are often much shorter than when the insect attacks stumps.

There is no fear of *Asemum* spreading from sickly trees to healthy ones, and the greatest inducement for it to attack is if the trees are burnt round the roots.

CRIOCEPHALUS FERUS.

My investigations in connection with *Asemum striatum* led to my exploring the Scotch fir woods of the New Forest.

In June 1902, in a grove of large trees, I observed a number of conspicuous holes in the trunks between a foot and fifteen inches from the ground. They were very like *Asemum* holes, distinctly oval and clean-cut, but the majority were much larger. Although it was raining heavily I proceeded to investigate the cause. In an hour or two I was rewarded by securing fifteen or sixteen large larvæ which looked much like *Asemum* larvæ but which I clearly saw were different. I supposed that the insect must be *Hylotrupes bajulus*. I was therefore much surprised when early in August I reared from them a long brown insect which certainly was not *Hylotrupes*. I at once searched the Birmingham libraries for information, and found in W. Rothschild's "Musée Entomologique Illustré" a short description and figure of *Crioccephalus rusticus*. I concluded that that was my insect, and accordingly so labelled it in my collection. Towards the end of the same month another emerged, and the only surviving larva, showing no sign of pupation, continued to burrow in its piece of wood. The reason I lost so many larvæ at this time was that at the time of capture I had not sufficient receptacles to enable me to keep each one separate. The larvæ proved to be very active and irritable, and in consequence before I arrived home all except three had received injuries.

Early in 1903 I made the acquaintance of Mr. Willoughby Ellis and informed him that I had taken *Crioccephalus* in the New Forest, and after seeing my specimens and the surviving larva, he accompanied me to the habitat. He subsequently wrote an article on the subject which appeared in the "Ent. Recd.," 1903, xv, 259.

In setting forth what I know of the life history of this insect, with which I subsequently became more fully acquainted, I will, in order to avoid repetition, mention chiefly those respects in which it differs from that of *Asemum striatum*.

In the first place, it attacks large trees that are standing and growing. When I discovered its habitat, the trees appeared in no respect to differ from the surrounding ones, but we now believe the vitality of these trees was somewhat impaired by some cause or other.

The wood in which the larvæ were boring was by no means dead; for when cut, sap freely exuded.

A careful examination revealed the fact that some of the roots were dead or dying and inhabited by *Asemum*.

The holes of *Crioccephalus* are usually further from the ground than in the case of *Asemum*, when that insect attacks trees.

Judging from the length of time that the larva appears full grown and lives in its completed burrow it would appear to be much longer-lived than *Asemum*.

The following, in addition to other evidence I have gathered, proves that this larva lives for a very considerable time in its completed burrow, viz.: early in August of last year I carefully opened two completed burrows which ran side by side; the unobstructed portion of each was of similar length, and I did not observe any difference. Each contained a larva; one of these was about to pupate, while the other, judging from its sluggish movements, appeared to be rapidly approaching that condition. I concluded that both would provide imagos last year. The former however pupated, while the latter simply underwent a larval ecdysis, and I hope to rear it this year; also the largest larva I have ever seen I procured at that time, but it will not mature till next August.

I am of the opinion that *Crioccephalus* while in the larval state always makes a hole for its exit as an imago and stuffs up the entrance with gnawed-down bark. I do not consider however that I have sufficient evidence to be quite positive on this point. It is interesting to note however that *Crioccephalus* forces a very much larger quantity of material into the end of its burrow than *Asemum* does, the stopped-up part sometimes extending right through the bark and into the wood itself where long wood-fibre is used.

This wood-fibre is quite different from any refuse found lower down its burrow and is only used for this purpose. When the bark is very thick the larva pupates in the bark itself, stopping up this portion of its gallery at each end. When it pupates in the wood it reserves a considerable portion of its burrow for its final stages and the pupa travels up and down as that of *Asemum* does.

Another interesting point about the burrows of these larvæ, and one which also shows that the larva lives for a considerable time in that portion of its burrow which may be termed its pupa-case, is that near the hole of exit the larva makes a short off-shoot, into which it pushes one of its discarded skins, and carefully covers over the entrance to it with wood-dust. The result of this performance is to place out of reach an object which would encourage the growth of fungi. In one of my specimens of these pupa-cases the annex containing the skin is full of mildew and putrefaction, while the pupa-case itself is quite free from any such thing.

Another noteworthy fact in the economy of this insect is the extreme lateness in the season at which the perfect insect appears. It apparently never undergoes its final metamorphosis in this country till about the end of July, although Dr. Sharp reared a specimen in June of last year. I think there is no doubt however that this was due to the high temperature of the room it was kept in and to its proximity to the fire. Having cast its pupal skin it is at the very least a fortnight before it is ready to leave its hiding-place. In large, well-developed specimens, it takes quite a considerable time for the distended abdomen to sufficiently contract not to be an impediment to the insect and to come within the limits of the elytra.

Having matured, it leaves its prison as the twilight is giving place to darkness.

It has been thought that it is a sluggish insect, but so far is that from the case that I believe it to be second to none of the British Longicorns for fleetness of foot and agility of wing. There seems no difference between the sexes in this respect. They both continue to fly and run about at a great rate late into the night.

I kept several alive last year and they all died about one month after maturing. They came from their hiding-places regularly at the same time every night, and once or twice I looked at them after 12 o'clock, and found

them still active. I succeeded in breeding with one pair, and have at present some of their offspring in a piece of bark.

I have on two or three different occasions observed them flying about in their natural habitat, and noted that the time at which they appeared was the same as in the case of specimens in captivity.

The eggs look exceedingly like those of the common blow-fly and are thrust deep down between the laminæ of the bark to which they are cemented. A female does not deposit many more than fifty or sixty eggs.

During the daytime the insect is perfectly inert, almost to the point of feigning death. It may be said to be at large from the middle of August till the middle of September, although I have specimens which did not cast their pupal skins till September.

I consider that the following considerations are responsible for this insect not having been observed previously:—

- i. The comparative rarity of suitable habitats.
- ii. The great difficulty in securing the perfect insect (though the habitat may be known) on account of its nocturnal habits and its great resemblance to the bark among which it hides.
- iii. The difficulty in securing the larvæ owing to the very hard wood into which they bore.
- iv. The unusual lateness in the season at which it appears.
- v. Its probable confinement to one spot for a great number of years.
- vi. The fact that pine woods in S. England have till lately been almost entirely ignored as unproductive by Coleopterists.

Most of the above considerations are doubtless responsible for the fact that *Asenum* up till 1902 was almost unknown as an inhabitant of Great Britain south of the Border. But as it does not appear "out of season" as *Criocephalus* does, and is so very much more common than that insect, it is indeed remarkable that it has not been better known by British collectors before.

Before bringing these notes on the habits of these two interesting insects to a close I must take this opportunity

of expressing my great indebtedness to Dr. Sharp, who has put every possible facility in my way to help me to complete my knowledge of these insects, and apart from whose generous assistance it would have been impossible for me to have contributed this very small item to the stock of entomological knowledge.

My thanks are also due to Mr. Ellis, Mr. Colbran J. Wainwright, and Mrs. Lamb of Brockenhurst, for help I have received in various ways.